

NWS Nashville presents:

# Weather 101 Flash Flooding

Presented by: Meteorologist Paige Baggett



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# 01 Flash Flooding Statistics

# 88 deaths per year

30-year national average of flash flooding-related deaths

Flash flooding is the **#1 weather-related killer** in the  
United States

# Startling Statistics



**1,000**

On average, around 1,000 flash floods happen per year in the US.



**50% of deaths**

A little more than 50% of flash flooding-related deaths occur in vehicles



**33 million**

Approximately 33 million people globally were affected by flash floods in 2020.



# 02 Meteorology of Flash Flooding

# What Meteorologists Look For When it Comes to Flash Flooding



## Slow winds

Slow winds = rain not blowing around = ponding



## Moisture

Sufficient moisture (> 70%) at the low and mid-levels is needed.



## Slow storm motion

Questions we ask: is there training potential?  
What forcing is there?



## Deep Cloud Layer

Deep warm clouds hold a lot more precipitation in the form of water.



## Precipitable Water Values

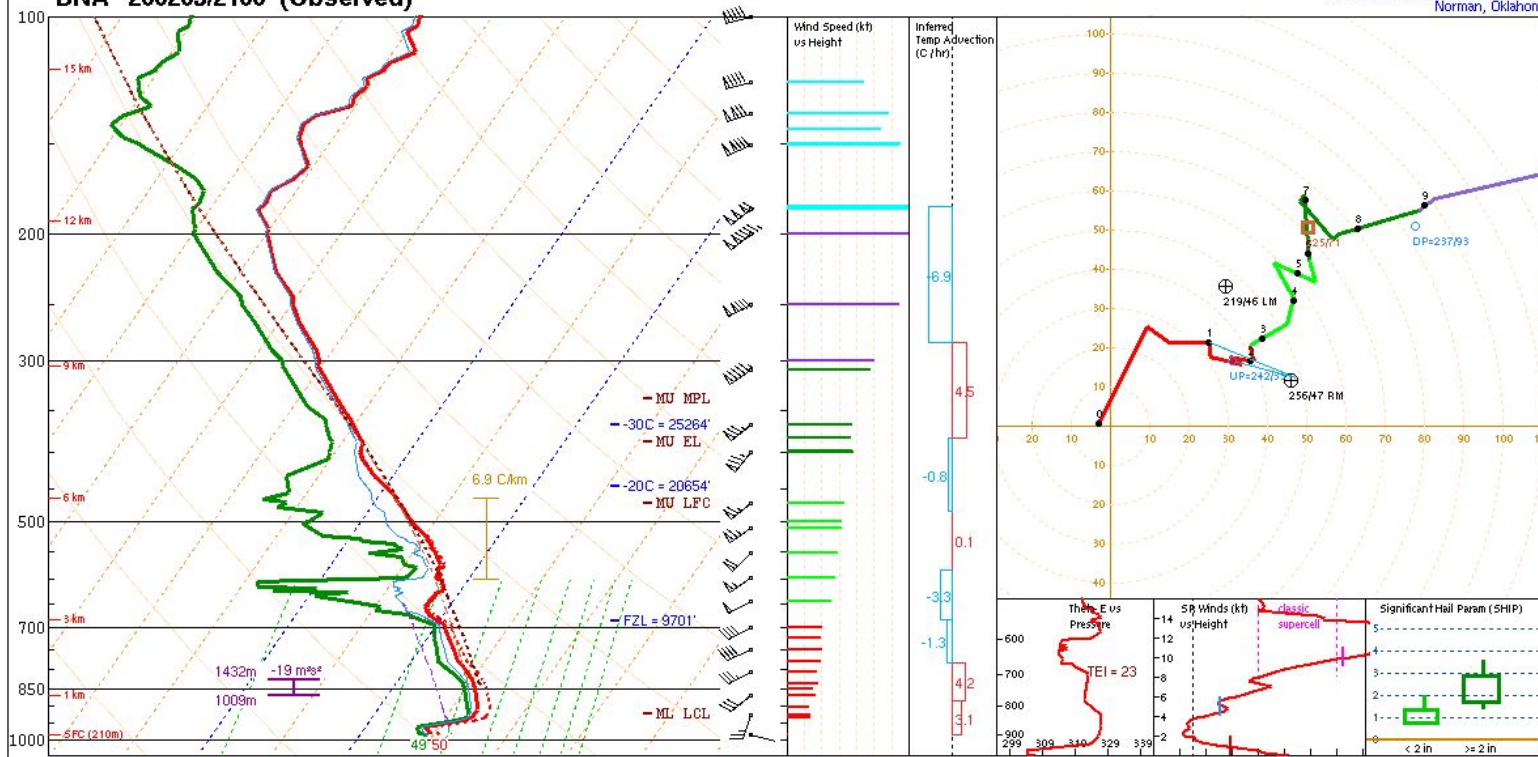
In or greater than the 75th percentile using local climatology



## Available Energy

Is there enough energy to generate clouds, thus producing rain?

# BNA 200205/2100 (Observed)



PARCEL	CAPE	CINH	LCL	LI	LFC	EL
SURFACE	1	0	36m	12	36m	718'
MIXED LAYER	0	0	512m	5	M	1681'
FCST SURFACE	146	-59	1411m	0	5868m	23974'
MU (850 mb)	143	-62	1358m	0	5868m	23974'

PW = 1.14 in	3CAPE = 2 J/kg	WBZ = 9476'	WWDG = 0.0
K = 33	DCAPE = 435 J/kg	FZL = 9701'	ESP = 0.0
MidRH = 75%	DownT = 55 F	ConvT = 80F	MMP = 0.97
LowRH = 93%	MeanW = 9.1 g/kg	MaxT = 75F	NCAPE = 0.10
SigSevere = 0	m3/s3		

**Supercell = -0.0**  
**Left Supercell = -0.1**  
**STP (eff layer) = 0.0**  
**STP (fix layer) = 0.0**  
**Sig Hail = 0.0**

	SRH(m2/s2)	Shear(kt)	MnWind	SRW
SFC - 1 km	292	35	209/20	98/39
SFC - 3 km	302	47	233/29	101/26
Eff Inflow Layer	-19	9	238/34	106/20
SFC - 6 km	69	233/36	118/20	
SFC - 8 km	82	232/41	128/20	
LCL - EL (Cloud Layer)	13	186/9	85/47	
Eff Shear (EBWD)	24	240/42	127/14	

BRN Shear = 97 m/s²  
 4-6km SR Wind = 180/26 kt

..... Storm Motion Vectors.....  
 Bunkers Right = 256/47 kt  
 Bunkers Left = 219/46 kt

Corfidi Downshear = 237/93 kt  
 Corfidi Upshear = 242/35 kt

1km & 6km AGL Wind Barbs

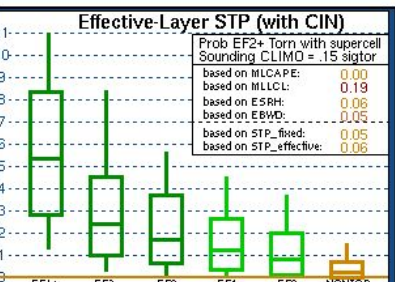
\*\*\* BEST GUESS PRECIP TYPE \*\*\*

**Rain.**  
Based on sfc temperature of 49.6 F.

**SARS - Sounding Analogs**

SUPERCCELL	SGFNT HAIL
No Quality Matches	No Quality Matches

SARS: 0% SIG

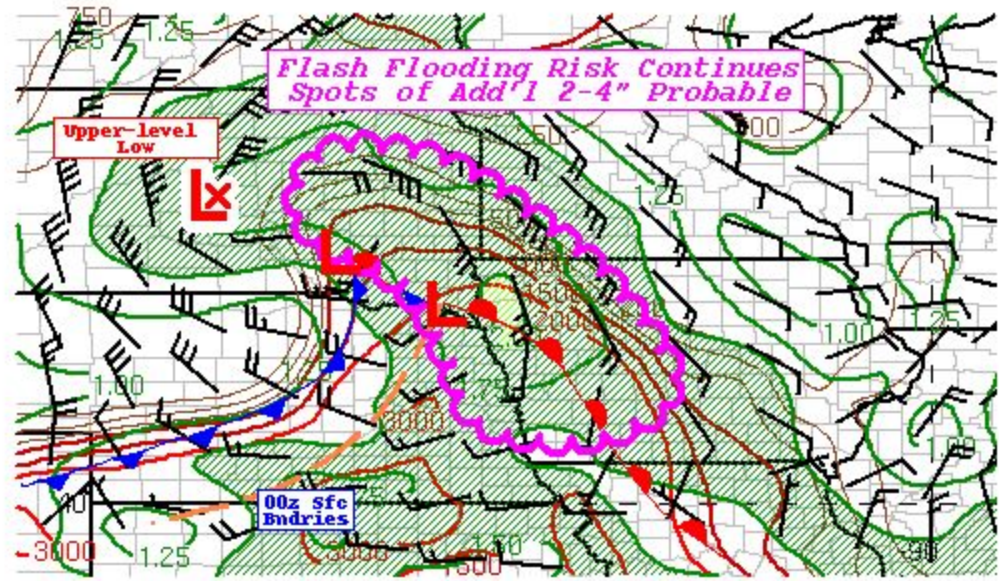




# Flash Flooding Ingredients

## Key elements to look for:

- High precipitable water values
- High relative humidity
- Moisture influx
- Convergence of winds
- Boundaries (fronts), particularly stationary boundaries
- Wind speed and direction aloft and near the surface



RAP32 MU CAPE 230805/2300f003  
RAP32 PRECIP WATER 230805/2300f003  
RAP32 850 MB WINDS 230805/2300f003  
WPC MPD #0875

# Know your Environment

## Questions we ask ourselves...

- Has it been raining a lot over the area of interest recently?
- What are the soil conditions like?
- Topography...Is it hilly, flat, mountainous?
- Is in an urban area where flooding can happen faster?



# The Steps We Take

- Figure out the threat
- Familiarize yourself with the environment
- Monitor the threat
- Issue watch
- Issue warning
- Follow-up warnings as often as needed depending on how the threat evolves.



# 03 Types of Flooding

# Types of Flooding

## River Flooding

- Takes longer to occur
- Typically have time to prepare and evacuate if needed
- Different sources of river flooding: persistent rain over a rain for a long period of time, melting snow, or an ice jam

## Flash Flooding

- Happens quickly as water rapidly rises
- Occurs generally in a matter of minutes to 6 hours or less during heavy rainfall
- **2 big factors:** *rainfall duration and rainfall intensity*

## Storm Surge

- An abnormal rise in water level along the coast.
- Generally caused by forces generated from a severe storm's wind, low pressure, and waves  
i.e. hurricanes

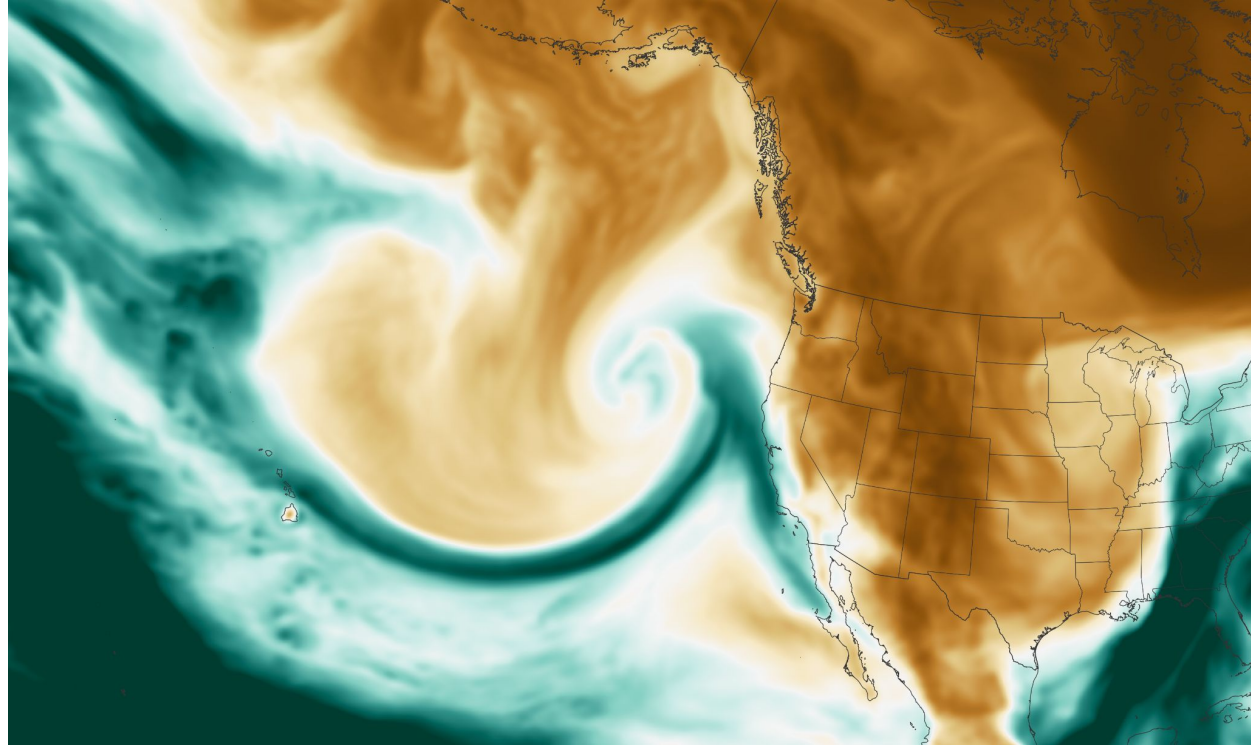
## Coastal Flooding

- Inundation of land along the coast caused by high tide

# Atmospheric Rivers

## Atmospheric Rivers

- Long, narrow regions in the atmosphere that transport large amounts of water vapor outside of the tropics. i.e. California
- Not all atmospheric rivers cause damage. Some provide beneficial rain or snowpack to an area in need.





# The science behind atmospheric rivers

An atmospheric river (AR) is a flowing column of condensed water vapor in the atmosphere responsible for producing significant levels of rain and snow, especially in the Western United States. When ARs move inland and sweep over the mountains, the water vapor rises and cools to create heavy precipitation. Though many ARs are weak systems that simply provide beneficial rain or snow, some of the larger, more powerful ARs can create extreme rainfall and floods capable of disrupting travel, inducing mudslides and causing catastrophic damage to life and property. Visit [www.research.noaa.gov](http://www.research.noaa.gov) to learn more.

A strong AR transports an amount of water vapor roughly equivalent to 7.5–15 times the average flow of water at the mouth of the Mississippi River.

ARs are a primary feature in the entire global water cycle and are tied closely to both water supply and flood risks, particularly in the Western U.S.

On average, about 30–50% of annual precipitation on the West Coast occurs in just a few AR events and contributes to the water supply — and flooding risk.

ARs move with the weather and are present somewhere on Earth at any given time.

ARs are approximately 250–375 miles wide on average.

Scientists' improved understanding of ARs has come from roughly a decade of scientific studies that use observations from satellites, radar and aircraft as well as the latest numerical weather models. More studies are underway, including a 2015 scientific mission that added data from instruments aboard a NOAA ship.

WATER  
VAPOR  
COOLS

CALIFORNIA

*Image not to scale.*



# Overflowing River

Numerous things can cause a river to overflow. A few are: persistent rain over a rain for a long period of time, melting snow, or an ice jam

Ice Jam- occurs when ice clumps together to block the flow of the river.



Nashville, May 2010

Photo credits: Micca Campbell



# Dam Break

- Dam breaks are often considered flash flooding due to the sudden nature of the break.
- Causes can be accumulation of melted snow, landslides, severe storms dumping large amounts of rain, jams caused by debris, etc.



Dam failure in Putnam County, Tennessee in April 2020

# Flash Flooding

- The fastest and most dangerous type of flooding.
- Can happen in a matter of minutes
- Very little time to prepare...**MOVE TO HIGHER GROUND!**
- **Do NOT drive through flood waters!!!**



# Storm Surge

- Common along coastal areas
- Storm surge is an abnormal rise in sea level during a storm.
- Storm surge is high during storms like hurricanes.
- Coastal flooding can occur due to high storm surge.





04

# Case Study

# Case Study - November 6-7, 2017 Walterhill, TN

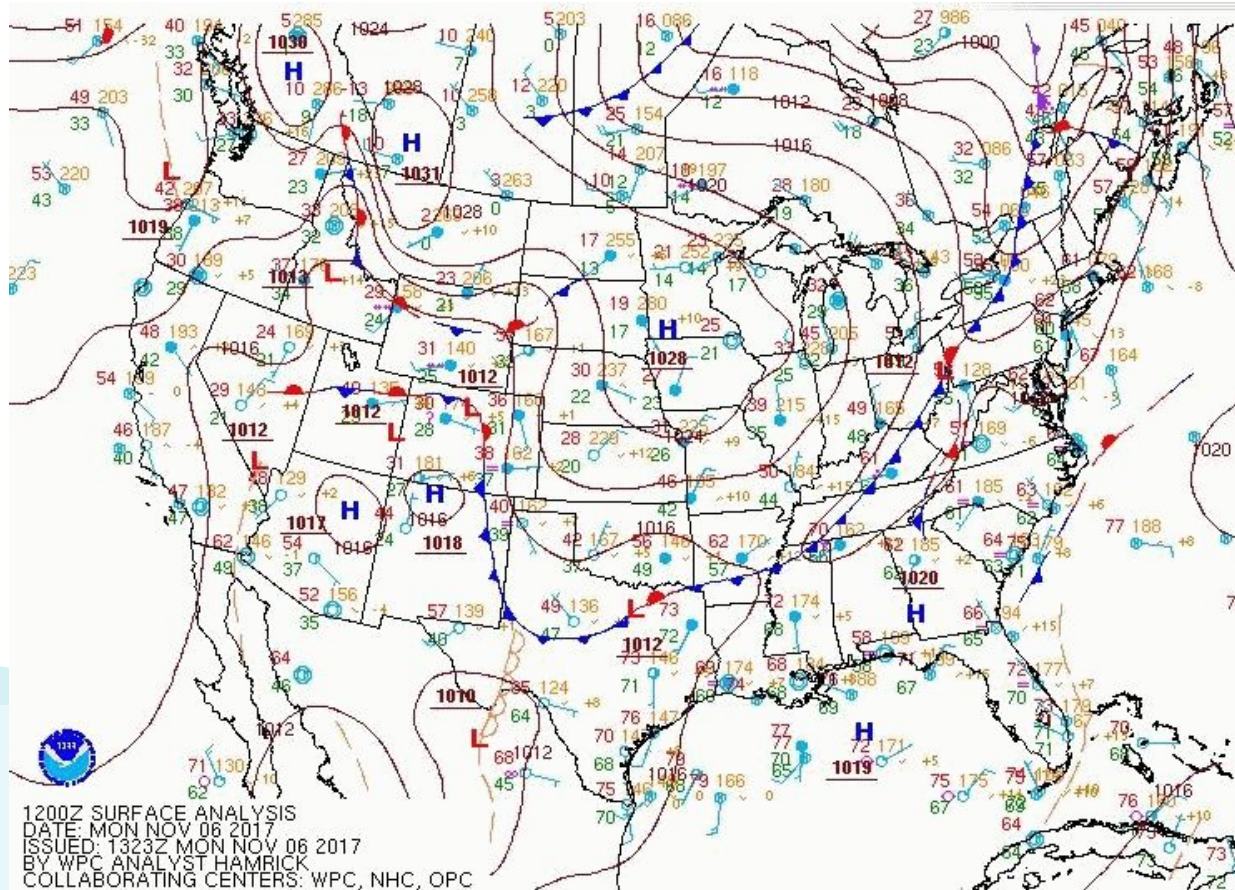
## Background Information

- A cold front moved through Middle Tennessee during the day on Monday, November 6th. By the evening hours, the front stalled out over northern Alabama.
  - The front eventually lifted north over Middle Tennessee
- This triggered several rounds of thunderstorms that trained along and north of the front boundary.
  - Over 6 inches of rain fell in some areas, resulting in widespread flash and river flooding from Humphreys County eastward across the southern Nashville metro area all the way over to Cumberland County.



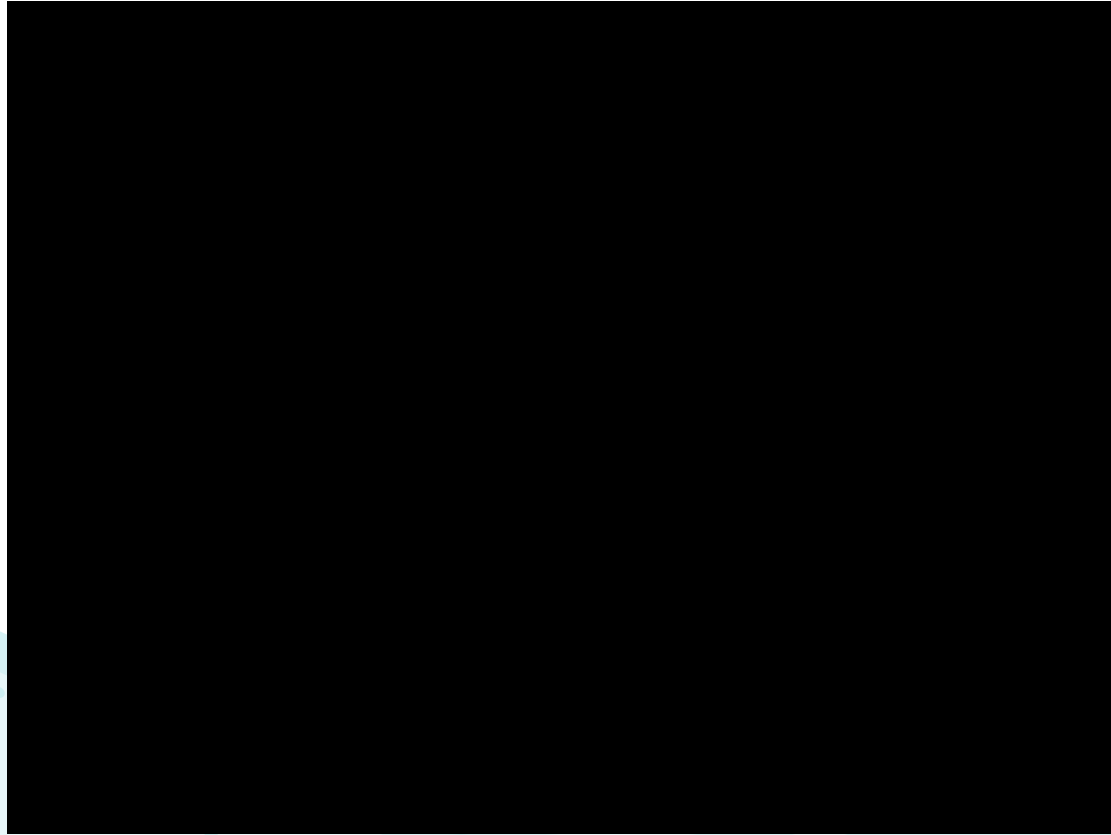
# Animated Surface Weather Map

## November 6th at 6 AM through November 7th 3 PM



# Radar Imagery

## November 7th, 7 PM through 1 AM



# Radar Imagery

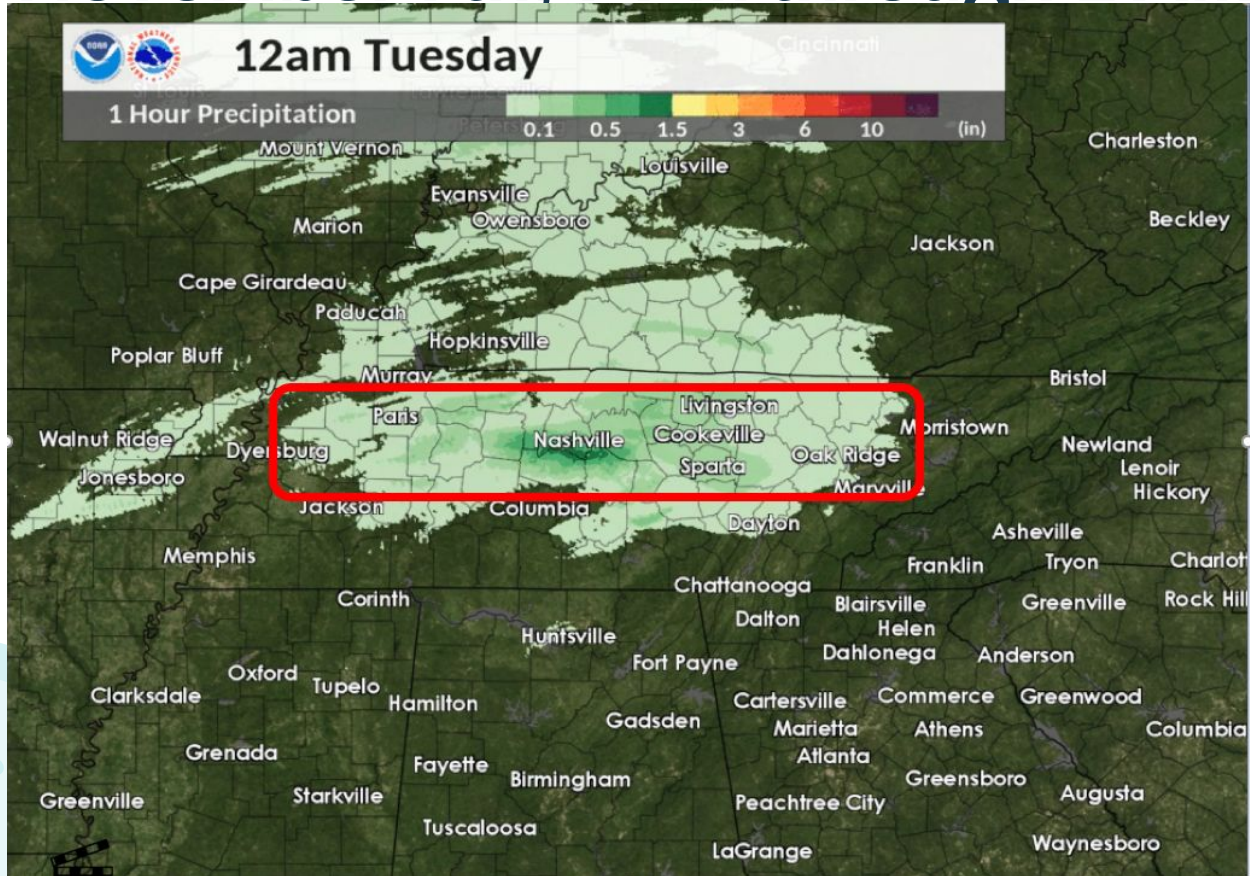
## November 8th, 1 AM through 7 AM



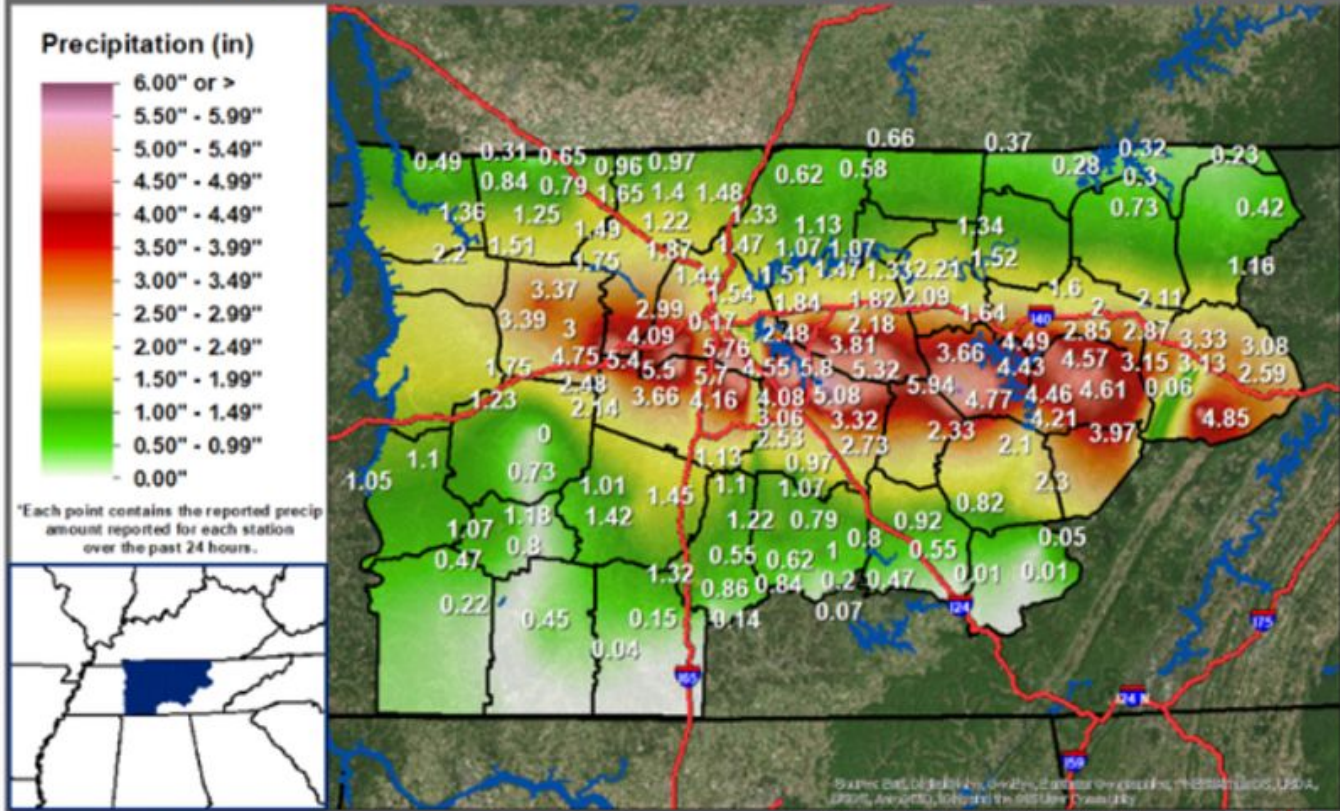


# Quantitative Precipitation

## November 7th, 7 PM through 1 AM



## Middle Tennessee 24 Hour Precipitation



**NWSNashville**  
weather.gov/Nashville

Map Created: 11/07/2017 12:00

\*This map is an interpolation of actual reported values from CoCoRAHS and NWS COOP Weather Observers.



# Rainfall Amounts

697  
NOUS44 KOHX 092120  
PNSOHX  
TNZ005>011-023>034-056>066-075-077>080-093>095-100920-

Public Information Statement  
National Weather Service Nashville TN  
320 PM CST Thu Nov 9 2017

...72 Hour Rainfall Totals...

Location	Amount	Time/Date	Provider
Statesville	6.05 in	0130 PM 11/09	GOES
4 WSW Smithville	6.03 in	0700 AM 11/09	COCORAHS
1 SW Kingston Springs	5.44 in	0700 AM 11/09	COCORAHS
2 ESE Smyrna	5.20 in	0400 AM 11/09	COCORAHS
2 W Walterhill	5.11 in	0700 AM 11/09	COCORAHS
6 S Crossville	4.96 in	0700 AM 11/09	COCORAHS
Kingston Springs	4.90 in	0430 AM 11/09	COCORAHS
3 SE Walterhill	4.82 in	0200 PM 11/09	HADS
Smithville 2se	4.80 in	0700 AM 11/09	COOP
1 WSW Sparta	4.79 in	0800 AM 11/09	COCORAHS
2 WNW Sparta	4.68 in	0600 AM 11/09	COCORAHS
Sparta	4.64 in	0800 AM 11/09	COOP
Big Lick	4.61 in	0200 PM 11/09	GOES
3 NNW La Vergne	4.57 in	0500 AM 11/09	COCORAHS
1 ENE Burns	4.48 in	0206 PM 11/09	RAWS
1 ENE Oak Hill	4.22 in	0700 AM 11/09	COCORAHS
3 ENE Doyle	4.22 in	0700 AM 11/09	COCORAHS
1 ENE Fairview	4.14 in	0630 AM 11/09	COCORAHS
3 ESE Doyle	4.08 in	0700 AM 11/09	COCORAHS
Sparta	4.06 in	0215 PM 11/09	GOES
3 NW Murfreesboro	4.02 in	0230 PM 11/09	GOES

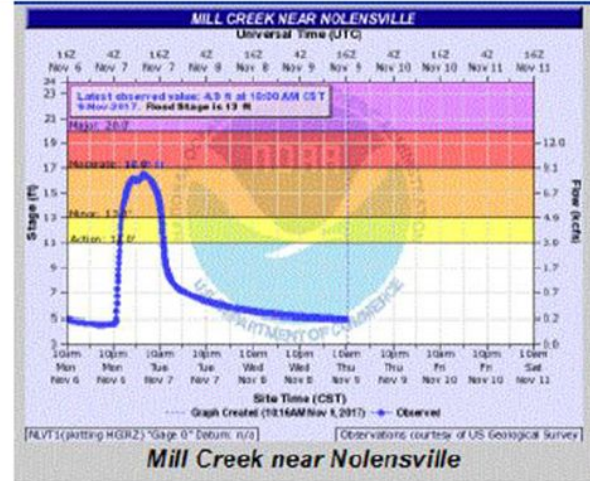
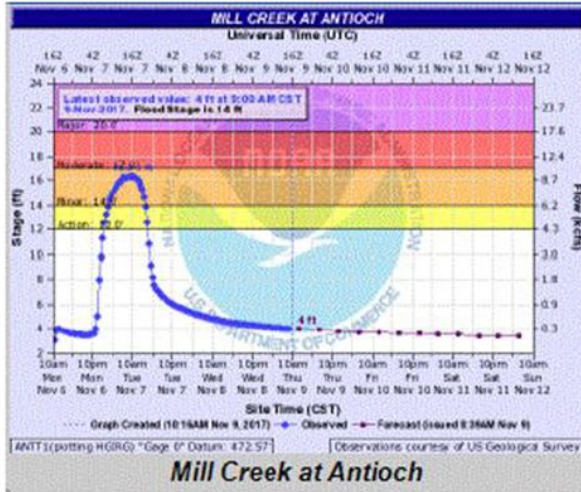
Observations are collected from a variety of sources with varying equipment and exposures. We thank all volunteer weather observers for their dedication. Not all data listed are considered official.

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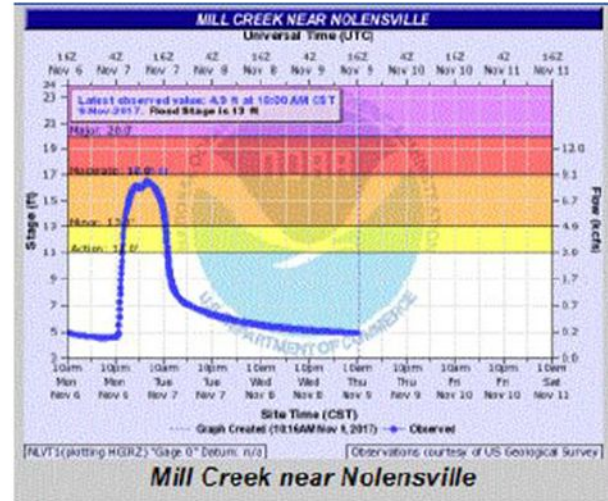
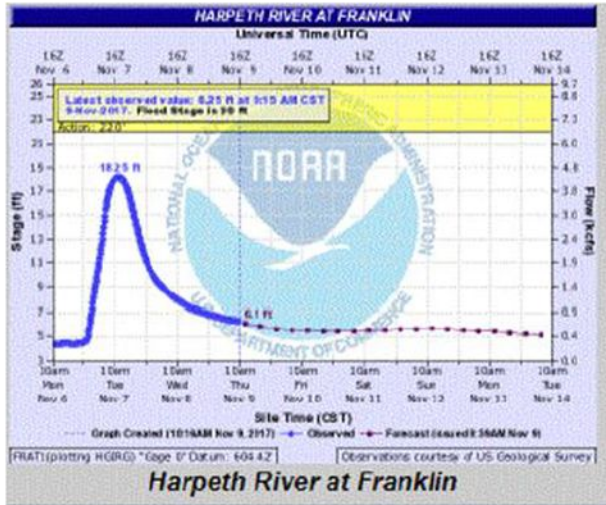
Shamburger



# AHPS Hydrographs

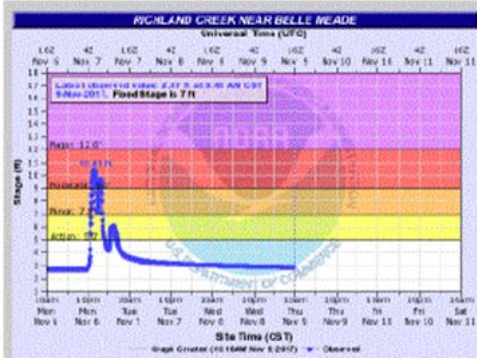


# AHPS Hydrographs

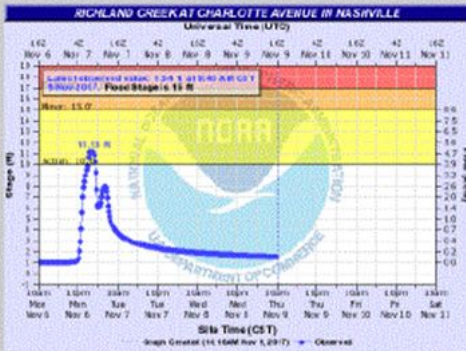




# AHPS Hydrographs



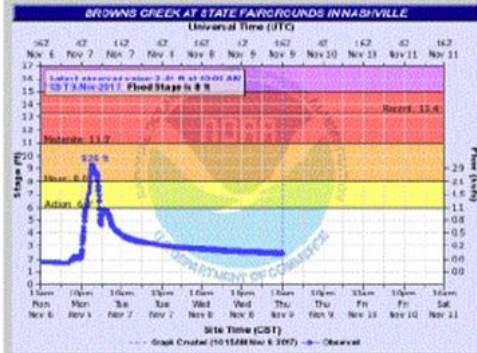
**Richland Creek near Belle Meade**



**Richland Creek at Charlotte Avenue in Nashville**



**Sevenmile Creek at Blackman Road**



**Browns Creek at State Fairgrounds in Nashville**




**Browns Creek at Glendale Lane**



**Winding Hills Lane in Gordonsville, TN (Smith County)  
Photo by Gina Johnson**

# Wrap up of Case #1

- Training storms can dump a lot of rainfall over an extended period of time
  - With that, high rainfall amounts are possible even if the rainfall intensity is low.
  - Overnight cases of this can be especially dangerous.
- 

# Case Study #2 - Cummins Falls State Park

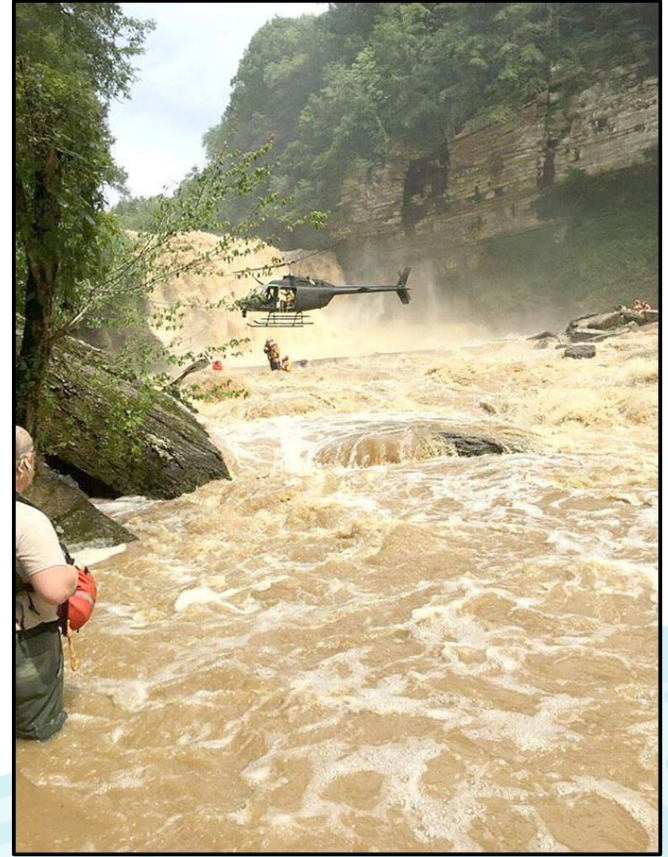
## Cookeville, TN. July 5, 2017

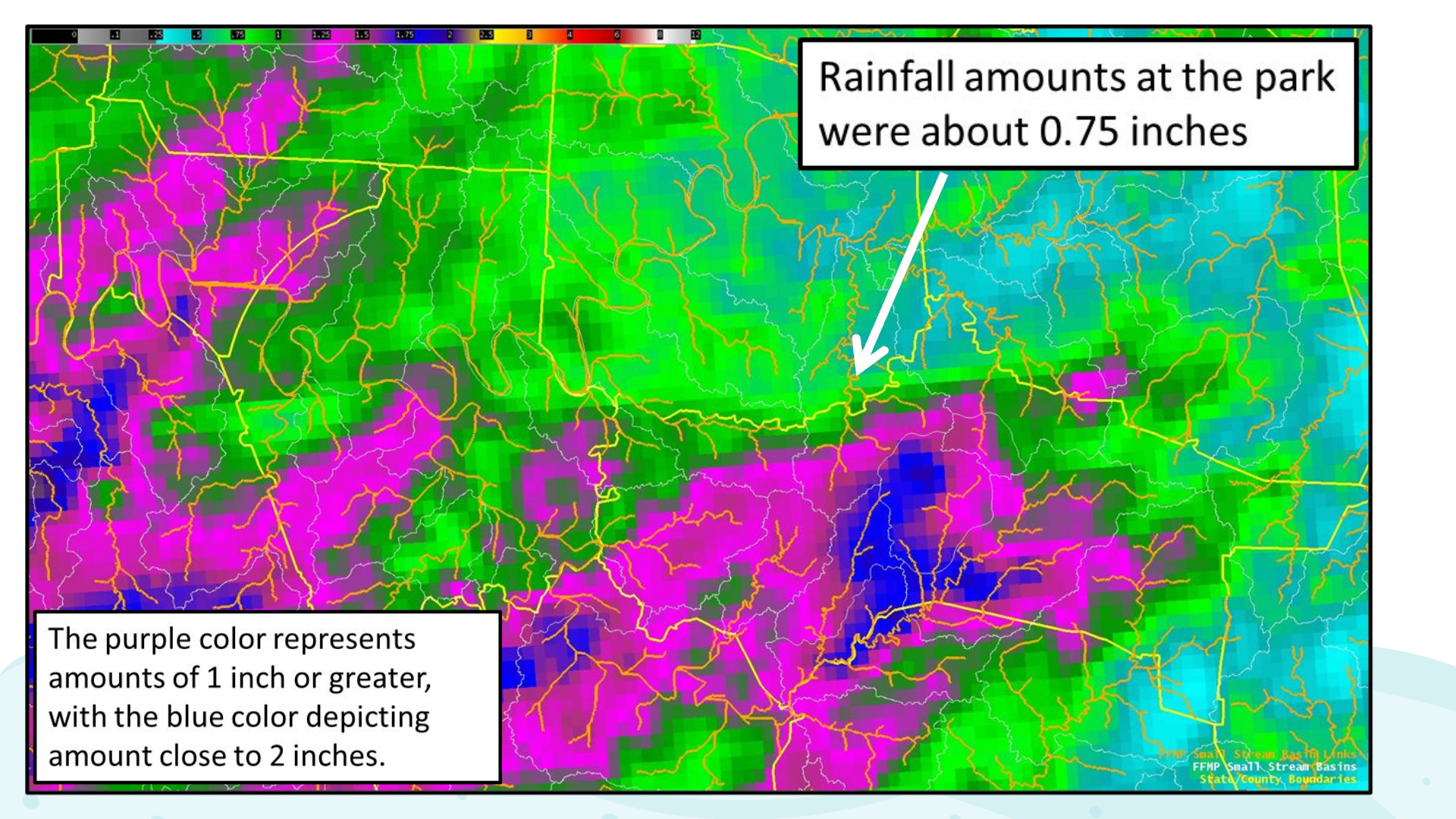




# Cummins Falls State Park Cookeville, TN.

- A line of strong thunderstorms moved across the area the afternoon of July 5.
- On the days leading up to July 5, there had been multiple days of rainfall, so the area was primed for flash flooding.
- Multiple water rescues happened and unfortunately, 2 fatalities occurred.



A map showing rainfall amounts across a region. The map is color-coded according to a scale at the top, ranging from 0 to 12 inches. The colors transition from blue (low rainfall) to green, yellow, orange, red, and finally purple (high rainfall). A network of yellow lines represents stream basins. A white arrow points to a specific location on the map. A legend in the bottom right corner identifies the symbols for Small Stream Basins, FFMP Small Stream Basins, and State/County Boundaries.

Rainfall amounts at the park  
were about 0.75 inches

The purple color represents  
amounts of 1 inch or greater,  
with the blue color depicting  
amount close to 2 inches.



3:49 pm



**3:51 pm**





**3:52 pm**



**3:54 pm**



**3:55 pm**






4:30 pm





## Wrap up Case #2

- The rainfall intensity was high in this situation
  - A lot of rain fell in a short period of time
  - Antecedent conditions were also moist due to several rounds of rain in previous days
- 



# 05 NWS Flood Products

# Flood Watch



**Flood Watch** means  
be prepared:  
Flooding is possible



Check for forecast updates



Prepare to move to higher ground



Stay weather ready

# Flash Flood Warning



**Flood Warning** means  
take action!

Flooding is expected





-  Move to higher ground immediately
-  Use extra caution if driving
-  Check forecast updates
-  Stay weather ready

Photo credit: USGS

[weather.gov/flood](https://www.weather.gov/flood)




# NWS Products

- Middle TN Hazardous Weather Report
- Flood Potential Outlooks (ESF)
- Flood/Flash Flood Watches (FFA)
- Flood/Flash Flood Warnings (FFW)
  - Dam Break – Downstream will be a Flash Flood Warning
- Flood Statements (FLS)
- Flood Advisories (FAY)
- Urban and Small Stream (FAY)



# Middle Tennessee Situation Report

 **National Weather Service** **Situation Report**  
Nashville, Tennessee Monday, April 6, 2020 2:49 PM

## Slight Risk of Severe Storms Midweek



### FORECAST SUMMARY

- Unusually warm through Wednesday then much cooler Thursday through the weekend
- A few showers today and tonight, with rain chances increasing tomorrow and Wednesday; showers and storms most likely Wednesday night into Thursday morning
- Some strong storms are possible Tuesday into Tuesday night with gusty winds and hail; a few severe storms possible Wednesday night into Thursday morning



# Hydrologic Outlook

FGUS74 KOHX 272034

ESFOHX

TN2005>011-023>034-056>066-075-077>080-093>095-281100-

Hydrologic Outlook

National Weather Service Nashville TN

334 PM CDT Sun May 27 2018

...Remnants of Subtropical Storm Alberto to Soak the Mid-State Tuesday and Wednesday...

The remnants of Subtropical Storm Alberto will move across Middle Tennessee Tuesday and Wednesday, and bring along some heavy downpours. Since the low pressure center is still expected to track close to Interstate 65, it looks like the heaviest rainfall will occur over western sections of the Mid-State, generally between Interstate 65 and the Tennessee River. This includes areas around Nashville, Clarksville, Dickson, Columbia and Waynesboro.

Between two and three inches of rain are likely to fall over western Middle Tennessee Tuesday and Wednesday, with locally higher amounts to around four inches.

Training of heavy showers will be likely, especially Tuesday afternoon and Tuesday night, and this will produce the possibility of localized flooding. In addition, heavy rain amounts will cause some creeks and streams in the Mid-State to run near bankfull. Right now it looks like the heaviest rains will occur over western Middle Tennessee. However, if the track of the low pressure system shifts further to the east, the area of heaviest rains will shift eastward as well.

# Flood/Flash Flood Watch

FFA0HX

Flood Watch  
National Weather Service Nashville TN  
355 PM CDT Tue May 29 2018

...Periods of Heavy Rainfall Are Expected Today into Tonight  
Across Middle Tennessee...

.Subtropical Depression Alberto is expected to approach and move across mid state through tomorrow morning. Storm total rainfall amounts 1.5 to 3.0 inches possible, with locally higher amounts approaching 4.0 inches near TN River Valley Region. One concern associated with tropical weather systems is likelihood for heavy showers training over the same area. Heavy rainfall can accumulate quickly and lead to possible flash flooding across these areas. Locations that have received saturating rainfall amounts over the previous few days could also be more prone to flash flooding.

TN2005>011-023>034-056>066-075-077>080-093>095-301200-  
/O.CON.KOHX.FF.A.0001.000000T0000Z-180530T1200Z/  
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/  
Stewart-Montgomery-Robertson-Sumner-Macon-Clay-Pickett-Houston-  
Humphreys-Dickson-Cheatham-Davidson-Wilson-Trousdale-Smith-  
Jackson-Putnam-Overton-Fentress-Perry-Hickman-Lewis-Williamson-  
Maury-Marshall-Rutherford-Cannon-De Kalb-White-Cumberland-Bedford-  
Coffee-Warren-Grundy-Van Buren-Wayne-Lawrence-Giles-  
Including the cities of Dover, Clarksville, Springfield,  
Hendersonville, Gallatin, Goodlettsville, Lafayette, Celina,  
Byrdstown, Erin, Waverly, New Johnsonville, McEwen, Dickson,  
Ashland City, Kingston Springs, Nashville, Lebanon, Mount Juliet,  
Hartsville, Carthage, South Carthage, Gordonsville, Gainesboro,  
Cookeville, Livingston, Jamestown, Allardt, Linden, Lobelville,  
Centerville, Hohenwald, Franklin, Brentwood, Columbia, Lewisburg,  
Murfreesboro, Smyrna, La Vergne, Woodbury, Smithville, Sparta,  
Crossville, Shelbyville, Tullahoma, Manchester, McMinnville,  
Altamont, Coalmont, Spencer, Clifton, Waynesboro, Lawrenceburg,  
and Pulaski  
355 PM CDT Tue May 29 2018

...FLASH FLOOD WATCH REMAINS IN EFFECT THROUGH WEDNESDAY  
MORNING...

The Flash Flood Watch continues for

\* A portion of Middle Tennessee, including the following areas,  
Bedford, Cannon, Cheatham, Clay, Coffee, Cumberland, Davidson,

8/21/2018

De Kalb, Dickson, Fentress, Giles, Grundy, Hickman, Houston,  
Humphreys, Jackson, Lawrence, Lewis, Macon, Marshall, Maury,  
Montgomery, Overton, Perry, Pickett, Putnam, Robertson,  
Rutherford, Smith, Stewart, Sumner, Trousdale, Van Buren,  
Warren, Wayne, White, Williamson, and Wilson.

- \* Through Wednesday morning
- \* Average rainfall amounts of one to three inches, with locally higher amounts approaching four inches.
- \* Some flash flooding is possible. In addition, you can expect rises to occur on area creeks and streams, and possibly along larger rivers as well.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

WGUS64 KOHX 28170Z  
FFA0HX

URGENT - IMMEDIATE BROADCAST REQUESTED  
Flood Watch  
National Weather Service Nashville TN  
1207 PM CDT Thu Jun 28 2018

...Heavy Thunderstorm Rains May Produce Flash Flooding Today...

.Several episodes of heavy thunderstorm rains are expected this afternoon over southern and western parts of Middle Tennessee, producing the potential for rain totals of 3 to 5 inches and localized flash flooding.

TN2023>025-056>061-075-077-093>095-290000-  
/O.NEM.KOHX.FF.A.0002.180628T1707Z-180629T0000Z/  
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/  
Houston-Humphreys-Dickson-Perry-Hickman-Lewis-Williamson-Maury-  
Marshall-Bedford-Coffee-Wayne-Lawrence-Giles-  
Including the cities of Erin, Waverly, New Johnsonville, McEwen,  
Dickson, Linden, Lobelville, Centerville, Hohenwald, Franklin,  
Brentwood, Columbia, Lewisburg, Shelbyville, Tullahoma,  
Manchester, Clifton, Waynesboro, Lawrenceburg, and Pulaski  
1207 PM CDT Thu Jun 28 2018

...FLASH FLOOD WATCH IN EFFECT UNTIL 7 PM CDT THIS EVENING...

The National Weather Service in Nashville has issued a

- \* Flash Flood Watch for a portion of Middle Tennessee, including the following areas, Bedford, Coffee, Dickson, Giles, Hickman, Houston, Humphreys, Lawrence, Lewis, Marshall, Maury, Perry, Wayne, and Williamson.
- \* Until 7 PM CDT this evening
- \* Several periods of heavy thunderstorm rains with potential totals of 3 to 5 inches.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

8/21/2018

A Flash Flood Watch means that conditions may develop that lead to flash flooding. Flash flooding is a very dangerous situation. You should monitor later forecasts and be prepared to take action should Flash Flood Warnings be issued.

&&

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# Flash Flood Warning - Standard

WGUS55 KBOU 250327  
FFWB0U  
COC087-250600-  
/O.NEW.KBOU.FF.W.0011.180725T0327Z-180725T0600Z/  
/00000.0.ER.000000T0000Z.000000T0000Z.000000T0000Z.CC/

BULLETIN - EAS ACTIVATION REQUESTED  
Flash Flood Warning  
National Weather Service Denver CO  
927 PM MDT TUE JUL 24 2018

The National Weather Service in Denver Colorado has issued a

- \* Flash Flood Warning for...  
North central Morgan County in northeastern Colorado...
- \* Until midnight MDT.

- \* At 926 PM MDT, Doppler radar indicated thunderstorms producing very heavy rain over Fort Morgan. The rain is moving southward. Up to three inches of rain have already fallen north of Fort Morgan. The town of Fort Morgan may see rainfall rates of up to 2 inches in 30 minutes. Flash flooding is expected to begin

HAZARD...Flash flooding caused by heavy rain.

SOURCE...Radar rainfall estimates.

IMPACT...Flash flooding of small creeks and streams, highways and underpasses.

- \* Some locations that will experience flooding include...  
Fort Morgan and Log Lane Village.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Be especially cautious at night when it is harder to recognize the dangers of flooding.

66

LAT...LON 4046 10398 4048 10378 4023 10378 4030 10389

HAZARD...Flash flooding caused by heavy rain.

SOURCE...Radar rainfall estimates.

IMPACT...Flash flooding of small creeks and streams, highways and underpasses.

FLASH FLOOD...RADAR INDICATED  
EXPECTED RAINFALL...2 INCHES IN 30 MINUTES

No Flash Flood  
Damage Threat tag



# Flash Flood Warning - Considerable

WJUS82 KMXK 180702  
FFWGXK  
MCCOL3-049-103-107-151000-  
/O.NEW.KMXK.FF.W.0017.180918T0702Z-180918T1000Z/  
/00000.O.BR.000000T0000Z.000000T0000Z.000000T0000Z.00/

BULLETIN - EAS ACTIVATION REQUESTED  
Flash Flood Warning  
National Weather Service Newport/Morehead City NC  
302 AM EDT SAT SEP 15 2018

The National Weather Service in Newport has issued

- Flash Flood Warning for...  
Northeastern Jones County in eastern North Carolina  
Northern Lenoir County in eastern North Carolina  
Craven County in eastern North Carolina...  
Southwestern Beaufort County in eastern North Carolina

Until 600 AM EDT.

- At 254 AM EDT, emergency management reported that  
rain bands associated with Tropical Storm Florence  
inches of rain have fallen since Thursday, and  
4 inches are possible across the warned area of

\* HAZARD...Flash flooding caused by heavy

\* SOURCE...Emergency management.

\* IMPACT...Life-threatening flash flooding of creeks and  
streams, urban areas, highways, streets, and underpasses.

- Some locations that will experience flooding include...  
New Barn, Kinston, La Grange, River Bend, Grifton, Blounts Creek,  
Vanceboro, Askins, Cayton, Fort Barnwell, Jasper, Tuscarora,  
Dawson, Rhams, Wilmar, Edward, Graingers, Institute, Cox Crossroads  
and Myse Fork.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Turn around, don't drown when encountering flooded roads. Most flood  
deaths occur in vehicles.

Be especially cautious at night when it is harder to recognize the  
dangers of flooding.

..

LAT...LON 3537 7780 3538 7770 3535 7767 3543 7748  
3535 7743 3533 7738 3533 7735 3538 7729  
3535 7725 3529 7724 3542 7719 3532 7716  
.....

**HAZARD...Flash flooding caused by  
heavy rain.**

**SOURCE...Emergency management.**

**IMPACT...Life-threatening flash  
flooding of creeks and streams,  
urban areas, highways, streets,  
and underpasses.**

**FLASH FLOOD...OBSERVED**

**FLASH FLOOD DAMAGE THREAT...CONSIDERABLE**



# Flash Flood Warning - Catastrophic

WGUS24 KMGX 271826

FFWGCM

TXCO12-039-071-137-167-185-201-231-339-473-477-280012-  
/O.NEW.KMGX.FF.W.0079.170827T1826Z-170828T0012Z/  
/000000.0.EB.000000T0000Z.000000T0000Z.000000T0000Z

BULLETIN - EAS ACTIVATION REQUESTED  
Flash Flood Warning  
National Weather Service Houston/Galveston TX  
126 PM CDT SUN AUG 27 2017

...FLASH FLOOD EMERGENCY FOR LIFE-  
FLOODING...

The National Weather Service in League City has is

\* Flash Flood Warning for...  
Northeastern Austin County in southeastern Texas  
Southeastern Grimes County in southeastern Texas  
Southeastern Washington County in southeastern Texas  
Galveston County in southeastern Texas...  
Southern Montgomery County in southeastern Texas  
Central Fort Bend County in southeastern Texas...  
Northeastern Brazoria County in southeastern Texas  
Western Chambers County in southeastern Texas...  
Waller County in southeastern Texas...  
West central Liberty County in southeastern Texas  
Harris County in southeastern Texas...

\* Until 715 PM CDT.

\* At 119 PM CDT, Doppler radar indicated continued bands of rain and thunderstorms across the area. Emergency management reported ongoing water rescues.

This is a FLASH FLOOD EMERGENCY FOR LIFE-THREATENING CATASTROPHIC FLOODING. This is a PARTICULARLY DANGEROUS SITUATION. SEEK HIGHER GROUND NOW!

HAZARD...Life-threatening flash flooding caused by heavy rain.

SOURCE...Emergency management.

IMPACT...Widespread, life-threatening flooding will continue and perhaps worsen at some locations. Historic flooding is expected to continue in the Houston metropolitan area through the foreseeable future.

\* Some locations that will experience flooding include...  
Pasadena, Pearland, League City, Sugar Land, Baytown, Missouri City, Galveston Island West End, Galveston Causeway, Texas City, Friendswood, La Porte, Deer Park, Rosenberg, Alvin, northwestern Angleton, Dickinson, Stafford, South Houston, Bellaire and Humble.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Move to higher ground now. This is an extremely dangerous and life-threatening situation. Do not attempt to travel unless you are fleeing an area subject to flooding or under an evacuation order.

##

LAT...LCN 2904 2912 2920 2927 2932 2936 2916 2943  
2919 2926 2947  
3026 2990 3012 2941 3010 2928 3014 2907  
2044 2244

FLASH FLOOD...OBSERVED

FLASH FLOOD DAMAGE THREAT...CATASTROPHIC

HAZARD...Life-threatening flash flooding caused by heavy rain.

SOURCE...Emergency management.

IMPACT...Widespread, life-threatening flooding will continue and perhaps worsen at some locations. Historic flooding is expected to continue in the Houston metropolitan area through the foreseeable future.

# Flash Flood Emergency

WOU871 KLMX 272040  
FFSLMX

Flash Flood Statement  
National Weather Service Baltimore MD/Washington DC  
440 PM EDT SUN MAY 27 2018

MDC008-027-272330-  
/O.CON.KLMX.FF.W.0017.000000T0000Z-180527T2330Z/  
/00000.0.PP.000000T0000Z.000000T0000Z.000000T0000Z.00/  
Howard MD-Baltimore MD-  
440 PM EDT SUN MAY 27 2018

...THIS IS A FLASH FLOOD EMERGENCY FOR Ellicott City in Howard County...

...THE FLASH FLOOD WARNING REMAINS IN EFFECT UNTIL 730 PM EDT FOR EAST CENTRAL HOWARD AND SOUTHWESTERN BALTIMORE COUNTIES...

At 439 PM EDT, Emergency Management reported multiple water rescues on Main Street in Ellicott City. Rainfall rates of 2-4 inches per hour are expected. Seek higher ground immediately.

This is a FLASH FLOOD EMERGENCY for Ellicott City in Howard County. This is a PARTICULARLY DANGEROUS SITUATION. SEEK HIGHER GROUND NOW!

HAZARD...Life-threatening flash flooding caused by heavy rain.

SOURCE...Emergency Management.

IMPACT...Multiple water rescues on Main Street in Ellicott City.

Some locations that will experience flooding include...  
Ellicott City, Catonsville, Woodlawn, Arbutus, Ilchester and Oella.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Move to higher ground now. This is an extremely dangerous and life-threatening situation. Do not attempt to travel unless you are fleeing an area subject to flooding or under an evacuation order.

Turn around, don't drown when encountering flooded roads. Most flood deaths occur in vehicles.

Move to higher ground now. Act quickly to protect your life.

zz

LAT...LON 3928 7671 3927 7670 3924 7670 3924 7678  
3928 7687 3927 7688 3931 7671

FLASH FLOOD...OBSERVED  
FLASH FLOOD DAMAGE THREAT...CATASTROPHIC  
EXPECTED RAINFALL...2-4 INCHES PER HOUR

88

**Very rare!!!**

# River Flood Warning

WGUS44 KOHX 070604

FLMOHX

Bulletin - Immediate Broadcast Requested

Flood Warning

National Weather Service Nashville TN

1204 AM CST Tue Nov 7 2017

...The National Weather Service in Nashville, Tn has issued a flood warning for the following rivers in middle Tennessee...

Richland Creek At Belle Meade Near Harding Place AFFECTING Davidson County

.Thunderstorms with heavy rain have caused creek in southern Davidson County to rise above flood stage.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Avoid flooded areas along the river...And move personal belongings to higher ground. Never drive through flooded roads as the depth of water may be too great to pass...Even in trucks or sport utility vehicles. If you come across a flooded road...Turn around don't drown.

Stay tuned to noaa weather radio or other local media for further information from the National Weather Service.

&&

TNC037-071804-

/O.NEW.KOHX.FL.W.0017.171107T0604Z-000000T0000Z/

/BMDT1.2.ER.171107T0511Z.171107T0545Z.000000T0000Z.UU/

1204 AM CST Tue Nov 7 2017

The National Weather Service in Nashville, Tn has issued a

\* Flood Warning for

The Richland Creek At Belle Meade Near Harding Place

\* From early this morning until further notice.

\* At 11PM Monday the stage was...10.0 feet

\* Flood stage is 7.0 feet.

\* The river will rise to near 11.0 feet then begin falling.

\* At 11.0 feet...The parking lot of Belle Meade Terrace condominiums begins to flood.

\* At 10.0 feet...The parking area near the creek and Harding Place begins to be flooded.

&&

LAT...LON 3606 8690 3617 8689 3616 8683 3606 8680

\$\$

Shamburger



# Flood Advisory

WGUS84 KOHX 070426  
FLSOHX

Flood Advisory  
National Weather Service Nashville TN  
1026 PM CST MON NOV 6 2017

TNC021-037-043-187-070630-  
/O.NEW.KOHX.FA.Y.0091.171107T0426Z-171107T0630Z/  
/00000.N.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/  
Davidson TN-Dickson TN-Williamson TN-Cheatham TN-  
1026 PM CST MON NOV 6 2017

The National Weather Service in Nashville has issued a

\* Flood Advisory for...  
Southern Davidson County in Middle Tennessee...  
Southern Dickson County in Middle Tennessee...  
Northern Williamson County in Middle Tennessee...  
South central Cheatham County in Middle Tennessee...

\* Until 1230 AM CST

\* At 1025 PM CST, Doppler radar indicated heavy rain due to thunderstorms continuing to move across the area. Radar estimates up to 2 inches of rain has fallen in the past hour from Dickson to Kingston Springs to Brentwood. This will cause minor flooding in the advisory area.

\* Some locations that will experience flooding include...  
Franklin, Dickson, Brentwood, Nolensville, Forest Hills, Oak Hill, White Bluff, Belle Meade, Kingston Springs, Pegram, Burns, Bellevue, Antioch, Fairview, Charlotte, Berry Hill, Bells Bend and Natchez Trace At Highway 96.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Be especially cautious at night when it is harder to recognize the dangers of flooding.

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# Urban and Small Stream

Flood Advisory  
National Weather Service Nashville TN  
559 PM CDT FRI AUG 17 2018

TNC061-180200-  
/O.NEW.KOHX.FA.Y.0103.180817T2259Z-180818T0200Z/  
/00000.N.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/  
Grundy TN-  
559 PM CDT FRI AUG 17 2018

The National Weather Service in Nashville has issued a

- \* Urban and Small Stream Flood Advisory for...  
Central and Southeastern Grundy County in Middle Tennessee...
- \* Until 900 PM CDT.
- \* At 559 PM CDT, Doppler radar indicated heavy rain due to thunderstorms continuing to move into the county. This will cause urban and small stream flooding in the advisory area. Doppler radar estimates up to locally two inches of rain have already fallen. The potential of up to another two inches of rainfall falling in isolated locations across central and southeastern portions of Grundy County that have already received rainfall as the afternoon hours have progressed.
- \* Some locations that will experience flooding include...  
Gruetli-Laager, Tracy City, Monteagle, Coalmont, Palmer, Pelham and Fiery Gizzard State Park.

This includes Interstate 24 between mile markers 128 and 134.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

In hilly terrain there are hundreds of low water crossings which are potentially dangerous in heavy rain. Do not attempt to cross flooded roads. Find an alternate route.

A Flood Advisory means river or stream flows are elevated, or ponding of water in urban or other areas is occurring or is imminent.

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LAT...LON 3524 8582 3523 8588 3524 8588 3530 8590  
3549 8554 3543 8554 3540 8549 3536 8551

# Hydrology VTEC Sheet

Hydrologic Product	Type	Required Application	Phenomena Code	Significance Code	Segmented
Areal Flood Watch	FFA	GFE/GHG	FA	A	Y
Flood Watch (Flash Flooding)	FFA	GFE/GHG	FF	A	Y
Forecast Point Flood Watch	FFA	RiverPro	FL	A	Y
Flash Flood Warning	FFW	WarnGen	FF	W	N
Flash Flood Statement	FFS	WarnGen	FF	W	Y
Forecast Point Flood Warning	FLW	RiverPro	FL	W	Y
Areal Flood Warning	FLW	WarnGen	FA	W	Y
Flood Statement to follow up a Forecast Point Flood Warning	FLS	RiverPro	FL	W	Y
Flood Statement to follow up an Areal Flood Warning	FLS	WarnGen	FA	W	Y
Flood Advisory for Urban and/or Small Stream Flooding	FLS	WarnGen	FA	Y	Y
Flood Advisory (General)	FLS	WarnGen	FA	Y	Y
Forecast Point Flood Advisory	FLS	RiverPro	FL	Y	Y
Hydrologic Outlook	ESF	GFE	None	None	N
Hydrologic Statement	RVS	RiverPro	None	None	N
Hydrologic Summary	RVA	RiverPro	None	None	N
River and Lake Forecast Product	RVD	RiverPro	None	None	N

# True or False

**•If I drive a pickup truck or large SUV, will this keep me safe from river flooding or flash flooding.**



# True or False

- **False!!!!**

- **As little as 6-12” of fast moving water can sweep most any vehicle off a roadway.**


**Besides, you can't determine the condition of the road bed under the water. The road could be washed out, or the water could be hiding a huge sinkhole.**



# True or False

- **A 500-year flood would be a 1 in 500% (.2 percent) chance of that magnitude of flood occurring in any year.**

# True or False

- True!!!!
  - A 500-year flood would be a 1 in 500% (.2 percent) chance of that magnitude of flood occurring in any year.
- 



06



**Conclusion**

# Flooding is DANGEROUS

**FLOODING AHEAD  
TURN AROUND  
DON'T DROWN**



## Never drive around barricades

-  Most flood fatalities occur in vehicles
-  12 inches of water can sweep a car off the road



[weather.gov/flood](https://www.weather.gov/flood) 

Don't underestimate the power of water!



6 inches of fast-moving water can knock over and carry away an adult.



12 inches of fast-moving water can carry away a small car.



18-24 inches of fast-moving water can carry away most large SUVs, vans and trucks.







# Thank you!

Do you have any questions?

**Email:** [paige.baggett@noaa.gov](mailto:paige.baggett@noaa.gov)

**Office Phone:** (615) 754-8500

**Website:** [weather.gov/ohx](http://weather.gov/ohx)



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